Some Recent Developments on Circulant-type Experimental Designs and Network Data Analysis

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摘要

This talk discusses some recent developments on the following two research areas:
(1) Circulant-type Experimental Designs. Design and analysis of experiments is important for cost-efficiency and variation reduction in the experiments conducted in scientific researches and industrial processes. Although many useful experimental designs have been well-developed in the past decades, some other new experiments require special structure on their experimental plans that are yet fully investigated. Experiments in functional magnetic resonance imaging (fMRI) are important for rendering precise statistical inference on brain functioning, but the theoretical construction of efficient designs for these important experiments were few in the literature. In the first part of this talk, the theoretical structure and the construction of circulant orthogonal arrays are introduced. Such designs can be applied to the experiments in functional magnetic resonance imaging to enhance the estimation ability on the HRF signal peaks when compared to traditional sequences.
(2) Network Data Analysis. The growth of social networks, in combination with the increasing sophistication of Big Data tools, has led to a burgeoning interest in a rich understanding of relationships among people, institutions, and more. A relevant setting for such a study is graph theory, together with its random counterpart. Many graph models have been employed to investigate the centrality of each cluster based on structure and attributes, such as degree, betweenness, eigenvector, and closeness. Each centrality is used for different purposes, but none of them is proposed for network spread. In the second part of this talk, a new measurement, domination centrality set, which combines the advantages of known methodologies without their drawbacks is introduced. Besides, an new algorithm based on domination centrality set will be proposed for the search of influential nodes with effective spreading. Furthermore, we also derived some theoretical methodologies that help users to avoid exhaustive and time consuming computation. We demonstrate this method to real-world network data analysis, such as Facebook social networks, Amazon product co-purchasing network, and DBLP collaboration networks.